

Challenges faced by IITs

The editorial on IITs in *Current Science*¹ addresses some issues faced by the Indian Institutes of Technology at Kharagpur, Bombay, Madras, Kanpur and Delhi. The editorial has commendably referred to as 'administrative alchemy', the declaration of Thomason College alias University of Roorkee as an IIT, 155 years after its founding! [The date of establishment of IIT Kanpur given as 1963, is incorrect. IITK was established in 1959 by the Govt. of India. IITK was incorporated as a Society in Kanpur on 14 December 1959 by the first Director (late) P. K. Kelkar, who had also handled IIT Bombay similarly about three years before. One of us (A.S.P.) joined IIT Kanpur on 16 October 1960 as the first professorial faculty member, the first ever Faculty Selection Committee having met on 30 August 1960.] We wish to address some issues, including postgraduate education and R&D in IITs.

The editorial was published on the occasion of the first IIT (Kharagpur) having completed 50 years and there having been a gathering of the alumni of the first five IITs in Cupertino, CA, USA, addressed by Bill Gates. Prior to this, a pan-IITs meet had been organized in Washington DC in October 2002. Another pan-IITs gathering is planned for the year 2004 in New Delhi. It is timely, therefore, to express some thoughts on IITs.

The 'brand equity' of IITs is there for all to see, and has been well-emphasized in the editorial. It basically relates to the excellent quality of undergraduate teaching and project work, and to a reasonable level of overall personality development. Motivated students, dedicated faculty, quality of campus life, good student/teacher ratio of 9 : 1, close student-faculty contact, well-thought-out curricula, excellent library collection and services, well-equipped laboratories, computerization and internet facilities, good technicians, fairly good infrastructure, etc. are some of the positive factors.

Some of the positive factors mentioned above are changing. For example, the student/teacher ratio has unfortunately increased, and may increase further. The fees having gone sky-high, compared to the highly subsidized structure earlier, may result in the loss of students who have done well in the Joint Entrance Examination (JEE) but who are unable to pay the fees. Worst of all, curricula are beginning

to get compartmentalized, subtly but perceptibly. In the 1980s, curricular re-adjustment had to be done because the duration of the B. Tech. course was reduced from five to four years. Core curriculum has slowly been eroded. It must be remembered that the brand equity of today's successful alumni has come out of their undergraduate curriculum three or four decades ago.

The editorial pointed out that there is substantial R&D activity in all IITs. Many members of the IITs' faculty have been the recipients of prestigious national and international awards or have been otherwise recognized, have published well, taken patents, been involved in science and technology affairs of India. Many have been chosen as Directors of national institutions and vice-chancellors of universities. Many students who had joined for a Master's degree or doctorate also have done well professionally. Overall, many alumni have become successful entrepreneurs within India.

One of the most important contributions of IITs has been putting an end to the British-given science-engineering dichotomy in engineering education. Nevertheless, with the passing away of the early innovative Directors of IITs and the retirement of early faculties in all IITs, there are signs of that dichotomy returning, as the editorial has also pointed out.

We wish to address the issue of postgraduate education and R&D in the light of IITs being 'special' institutions, not only by an Act of the Indian Parliament, but also in the public psyche. We point out only some factors, without the pretence of comprehensive coverage.

To a large extent, the public identifies IITs with JEE, the only competitive examination in India that has retained an uncorrupt image for 42 years. Students aspiring to enter IITs begin intense efforts as soon as they pass the class X or equivalent examination, often earlier, whereby they get at least two years to study for JEE. They are thus conditioned from an early age by their families and schools to look for the best schools of higher education. However, not many students who enter IITs and eventually graduate, continue for their M. Tech and Ph. D. degrees there. To them, IITs do not seem to be anywhere near what they perceive as the quality of institutions in USA and UK.

This perception may have been passed on, even if unwittingly, by their IIT teachers. It would be ungracious to say that non-IIT institutions do not produce good graduates. The fact probably is that the best from these institutions also have their eyes on institutions abroad. While IITs lose some graduates to prestigious universities and better job opportunities abroad, it does not always have to be so. High quality postgraduate work can lead to excellent opportunities at home.

The era when research students got no emoluments is ancient history in India. Today, every research student gets substantial money to live on without worry; *that* cannot be a factor for youngsters wanting to go abroad for research rather than join IITs. As for faculty members, there are many agencies where they can apply for funds, so lack of funds for research cannot be a factor.

There was a time when teaching load (a rather bad term for 'teaching work') depended on designation. In most universities, lecturers were burdened with much teaching, and professors had hardly any teaching to do. This did not result in greater amount of and more important research being done. Thanks to IITs, with a sea change in the perception of what a faculty member was supposed to do, this scenario has changed, although some universities continue with the practice. In IITs, every faculty member is expected to teach, do research, guide research students, and generally participate in academic – sometimes community – administration. By hindsight, one wonders if this is the best model. In other words, should someone whose output in terms of quality (definitely not quantity) far exceeds that of others, be given less or no teaching work?

The truly motivated, curious and driven faculty member can and will start research with little or no encouragement and assistance. It is seen that new faculty members continue with their doctoral or postdoctoral work, especially since they see that the seniors are doing the same, year after year. For a few years, this is inevitable. The unfortunate situation in India is that most researchers continue working in the same field until they retire, often with accolades. One universal technique for change, followed in IITs as well as universities, also by established faculty mem-

bers, is to go abroad for a year or two, imbibe what the foreigners do and, on return, keep working in the same field. Again, this does not result in exciting research, as prospective students see. What all this means is that senior researchers generally fail to provide leadership for junior faculty members to get started in a way that will lead to truly exciting research on a world scale. Efforts should be increased to seek worthwhile research problems in fields of concern in the Indian economy. Suitable problems can capture the interest of postgraduate engineering students. For science students, what matters is 'frontline, world-level research' that, unfortunately, is not necessarily or readily available in any institution in India.

'Project work' is now a universally accepted part of the undergraduate curriculum, which also was initiated as a requirement by the IITs. Often publications have come out of undergraduate project work. Nevertheless, project work, as understood in this context, is not research per se. Students, even school students, are enamoured of research. There still is magic in that word. Can that enamouring not be exploited? If undergraduates are involved in research, not only will they be ready for a research career, but also will the funded

research projects benefit. Motivated students tend to learn a lot by self-study, with only a little orientation. At the mid-undergraduate level, research would however be only a part-time involvement.

To summarize:

(i) The record of IITs inspires confidence that they would continue playing their role as hitherto, which is a strong argument to support IITs even more than in earlier times. Elitism does have its values and rewards.

(ii) JEE remains the symbol of 'quality with integrity' of IITs, and should be jealously guarded against administrative and political interference.

(iii) The problem of 'teaching versus research' will remain an enigma, but it is possible to handle it delicately without detriment to either.

(iv) The element of elective courses in undergraduate curricula needs to be enlarged in innovative ways, consistent with world developments.

(v) Involvement of undergraduate students in serious research should be introduced, without upsetting the apple cart too much. The recently much-publicized experience of IIT Kanpur in Computer Science is telling.

(vi) Further discussion is needed to raise the postgraduate image of IITs to world standards. It is a mistake to take the success of postgraduate alumni later elsewhere as a measure of the local research atmosphere.

(vii) The science-engineering dichotomy that has just germinated, needs to be curbed. One way is to strengthen integrated core curricula. Another is to further emphasize interdisciplinary approaches.

1. Balaram, P., *Curr. Sci.*, 2003, **84**, 613–614.

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Teaching and research programmes in science in Indian universities

The familiar rush of the faculty and leadership of universities to become sycophants of the regime in power is not so uncommon in our times in India. A number of problems of teaching faculty and relevance or otherwise of science courses, plaguing our universities today, could be attributed to this. Several disturbing reports deal with the decline in the number of students opting for undergraduate courses in basic sciences. There have also been talks of 'private funding' of science education and research in Indian universities by both the University Grants Commission (UGC) as well as the government. While the model of private-funded university seems to have worked and driven first-class research in the American university system to a large extent and in some institutes in Europe, we must ask the following questions: Are Indian universities ready to take up this model? What is the problem with teaching and

research programmes in science in the university system?

Most private enterprises in India, if they were willing to pay the universities for carrying out research, would most likely only fund so-called applied research. Many Indian universities today seem to have abdicated their central mission in a democracy, and turned over decisions on what can be correctly studied, and what is excellent, to political power centres.

In the 1993 UGC's Punnayya committee report there had been a reference to universities earning and contributing to part of their budgets and there was also a mention of increasing the earnings of the universities by 25% in the next ten years. Ten years have passed and there are a few left in the university system who maintain a research profile and effort consistent with this much maligned mission statement of the UGC.

Science departments in most universities have either not reacted to the harsh realities of the fast changing world or are still slumbering under archaic or irrelevant courses and poor infrastructure facilities. Some universities which did wake up to the challenges of globalization and education as a resource-generating means have attempted to start courses in sciences that are competitive and current in their content and are improving their academic infrastructure. However, many science departments have not upgraded their academic programmes and research standards.

Many committed scientists who want to make a difference to science education and research programmes in India, complain that due to lack of either specific goal-oriented science policies or confusion on what should be best funded – basic science or applied work, no sustained effort is taken up by the concerned departments. Many of them mention that